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Brief Communication

BRIEF COMMUNICATION

Identifying Cancer-Related Cognitive Impairment Using the FACT-Cog Perceived Cognitive Impairment

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Abstract

Cancer-related cognitive impairment (CRCI) is a concerning problem for many cancer survivors. Evaluating patients for CRCI has been a challenge, in part because of a lack of standardized practices. Self-report instruments are often used to assess CRCI, but there are no validated cutpoints. We present the results of receiver operating characteristic curve analysis identifying cutpoints of the Functional Assessment of Cancer Therapy—Cognition perceived cognitive impairment (PCI) in female breast cancer survivors for identifying CRCI cases. We defined presence of CRCI based on elevated complaints on the Patient's Assessment of Own Functioning Inventory compared with healthy control scores. Our results indicate that scores less than 54 in PCI scores using 18 items and scores less than 60 in PCI scores using 20 items exhibited good ability to discriminate CRCI cases from noncases (area under the receiver operating characteristic curve was 0.84 [95% CI = 0.73 to 0.94]). These preliminary results represent an important contribution toward standardizing practices across CRCI studies.

Cognitive problems after cancer and its treatment, often referred to as cancer-related cognitive impairment (CRCI), are a concerning adverse effect for many survivors. Evaluating CRCI in research and clinical settings is challenging without standardized methods for classification. Self-report measures of cognitive dysfunction (1) are often preferred for assessing CRCI, but there are no established cutpoints for some of the most commonly used instruments. Common measures and cutpoints for classifications are important for standardizing definitions of CRCI. Further, it is difficult to compare study samples and evaluate potential interventions without definitions of "caseness."

The Functional Assessment of Cancer Therapy—Cognition (FACT-Cog) (2,3) was developed specifically to assess cognitive difficulties in cancer survivors, and it is regularly employed in observational and treatment studies (4,5). For version 3 of the FACT-Cog, the scale developers recommend using one of the four subscores, the perceived cognitive impairment (PCI) score, as the preferred outcome (6), and it is the one most often cited in the literature. Surprisingly, no cutpoints have yet been established for the PCI score. To address this gap, we examined the receiver operating characteristic (ROC) curves for the PCI score against a validated CRCI classification measure, and then examined the performance of emergent cutpoints.

The Mind Body Study was a prospective longitudinal study examining the effects of breast cancer treatments on cognitive functioning from the end of primary treatment through 6 years. The study has been previously described in detail, and it involved intensive cognitive and psychosocial assessments (7–9). The FACT-Cog version 3 was added at the final timepoint of this study (approximately 3–6 years after participants completed primary cancer treatment), and we examined data only from this time point in a cross-sectional manner for this report.

Participants were recruited through clinical oncology practices and rapid case ascertainment of stage-eligible patients from collaborating physicians and hospitals identified through the Los Angeles Surveillance, Epidemiology, and End Results Program registry. Participants were aged 21–65 years, had a recent early-stage breast cancer diagnosis, and completed primary treatment within the last 3 months (8). Women with active psychotic or major depressive disorders, or any history of

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Table 1. Demographics of breast cancer survivor sample

	Whole sample (n = 133)	Training set* (n = 80)	Validation set* (n = 53)
Age, mean (SD), y	56.61 (7.82)	56.35 (8.7)	57 (6.32)
Education (≤ college), No. (%)	68 (51)	62 (78)	45 (85)
Race (% white), No. (%)	106 (80)	62 (78)	44 (83)
Years since Dx, mean (SD)	4.31 (0.64)	4.23 (0.63)	4.26 (0.66)
Chemotherapy Tx No. (%)	73 (55)	49 (61)	24 (45)
Radiation Tx No. (%)	100 (75)	59 (74)	41 (77)
Stage at diagnosis No. (%)			
0	19 (14)	11 (14)	8 (15)
I	58 (44)	30 (38)	28 (53)
II	44 (33)	30 (38)	14 (26)
III	12 (9)	9 (11)	3 (6)
Estimated verbal IQ (WTAR), mean (SD)	114.74 (8.78)	115.60 (8.67)	113.43 (8.85)

*No differences between groups on any variable based on *t* test or X^2, *p* greater than .05. Dx = diagnosis; Tx = treatment; WTAR = Wechsler Test of Adult Reading.

Table 2. Classification performance of FACT-Cog PCI in the validation dataset*

		Classification		Sensitivity (95% CI)†	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)
		Impaired	Not impaired				
PCI - 18 (< 54)	Impaired	11	3	79	92	79	92
	Not impaired	3	36	(49 to 95)	(79 to 98)	(49 to 95)	(79 to 98)
PCI - 20 (< 60)	Impaired	11	3	79	92	79	92
	Not impaired	3	36	(49 to 95)	(79 to 98)	(49 to 95)	(79 to 98)

*FCIs are exact binomial confidence intervals. FACT-Cog = Functional Assessment of Cancer Therapy—Cognition PCI = perceived cognitive impairment; PPV = positive predictive value; NPV = negative predictive value.
†CIs are exact binomial confidence intervals.

treatments or conditions with known effects on cognition or inflammation, were excluded. The UCLA institutional review board approved the study, and all participants provided written informed consent.

All participants completed the FACT-Cog version 3 at the last longitudinal follow-up assessment; this version was after study initiation and added to this time point because it was a standard in studies of this population (2,3). Standard scoring yields four domain scores, and for this report we focus only on the PCI, which includes 20 items total. Historically, only 18 were scored to get the PCI (PCI-18; range 0-72), but there is now more evidence to support the validity of including all 20 items in the score (PCI-20; range 0-80) (10); this report examines both PCI-18 and PCI-20 scores.

Participants also completed the Patient's Assessment of Own Functioning Inventory (PAOFI) (11), commonly used to capture self-assessed difficulties in various populations across several domains of cognitive function. The PAOFI total is calculated based on the number of items rated as high severity, ranging from 0–33, in which higher is worse functioning. Comparison PAOFI data were available from healthy control women without breast cancer enrolled in a study at the University of California, San Diego (UCSD) (12) (n = 63; mean age 51.96 [± 9.35 years]; 63% ≤ college education; 79% white), and used in earlier Mind Body Study reports to classify cognitive impairment in the breast cancer patients (8). Cognitive impairment on the PAOFI total was established as greater than 2SDS above the mean of the healthy control sample (ie, > 6 on the PAOFI total in healthy women) (8).

Sixty percent of the breast cancer survivor sample was randomly selected for the training dataset, and 40% for the validation dataset using a random number generator in SPSS. We plotted two ROC curves using the training dataset for each PCI score and manually identified the cutpoint yielding highest sensitivity and specificity estimates. We then calculated estimates of sensitivity specificity, positive predictive validity (PPV), and negative predictive validity (NPV) in the validation dataset. Analyses were conducted using SPSS (IBM SPSS Statistics for Windows, V.24.0. Armonk, NY: IBM Corp).

A total of 133 breast cancer survivors were evaluated; see Table 1 for sample demographics. There were 80 survivors in the training dataset and 53 in the validation data set. The training dataset consisted of 17 impaired and 63 not impaired participants; the validation dataset consisted of 14 and 39, respectively.

The area under the ROC curve was 0.84 (95% CI = 0.73 to 0.94) for both PCI-18 and PCI-20. Examining the coordinates of the ROC curves for each measure, the following cutpoint scores were identified in the training set: PCI-18 less than 54, 76% sensitivity, and 82% specificity; PCI-20 less than 60, 76% sensitivity, 84% specificity. These cutpoints exhibited good classification performance in the validation dataset; see Table 2.

This report is the first to describe cutpoints on the FACT-Cog PCI to classify CRCI. In addition to the commonly used 18-item PCI, we also examined the full 20-item PCI, which is currently being validated and used in the research community (10). Both PCI-18 and PCI-20 showed good discriminative ability to classify CRCI.

The field of CRCI is presently lacking in standardized classification methods using targeted subjective instruments, and these findings offer a valuable starting point. Cutpoints can help standardize methods and CRCI definitions across research studies to improve congruity and accelerate progress. Cutpoints may also be useful for identifying patients in need of services, but this would require further study.

This study has limitations in that it is a relatively small and exploratory extension of a larger study of breast cancer survivors—not specifically designed to test whether these cutpoints have relevance for a variety of important outcomes (eg, functioning). In addition, participants in our sample were several years out from completing cancer treatments, which could call into question the validity of these cutpoints in patients and survivors more proximal to undergoing treatment. Future research will be important to validate the relevance of these cutpoints in other varied cancer populations.

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Notes

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